

NDIA TACTICAL WHEELED VEHICLES CONFERENCE

Monterey, California

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**TECHNOLOGY & MAINTENANCE COUNCIL
BRAKE TECHNOLOGY TASK FORCE**

ECBS / Air Disc Brakes

ArvinMeritor



MERITOR WABCO

Electronic Braking System (EBS)

Charlie Schott

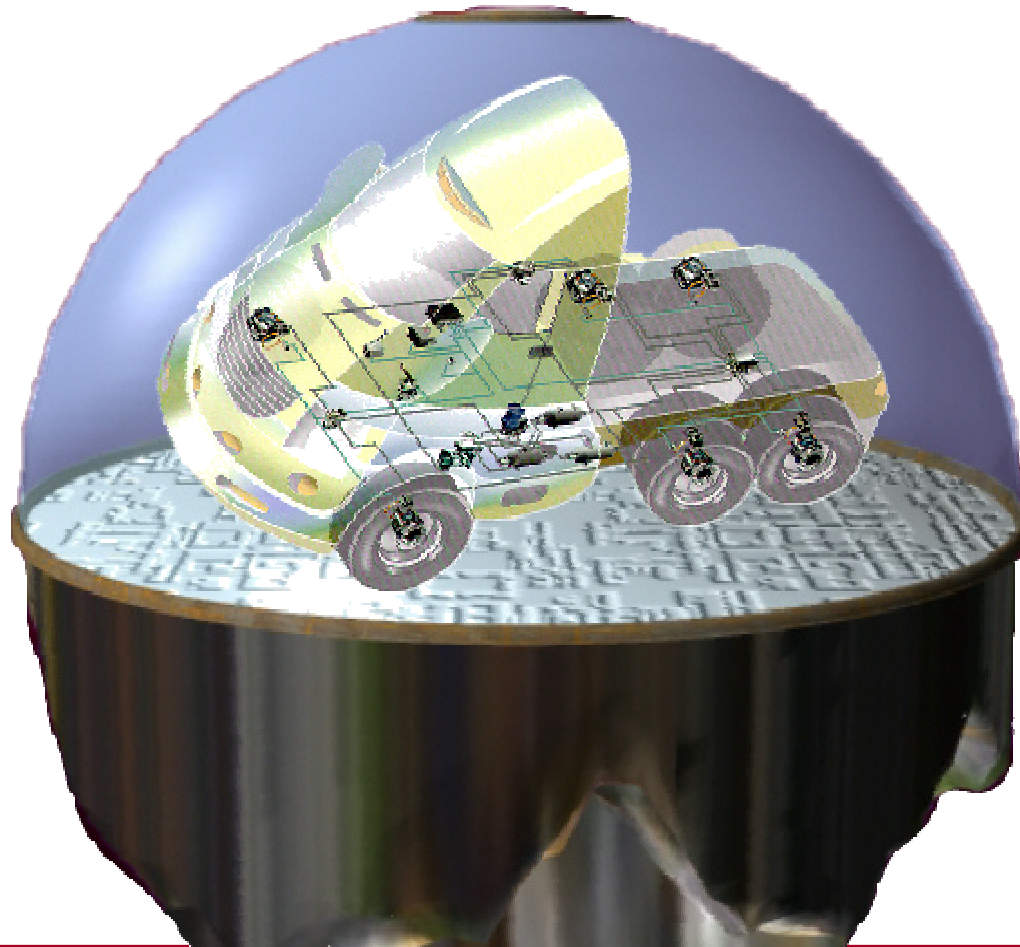
MERITOR WABCO

Products

- Electronic Braking System (EBS)
- Electronic Stability Control (ESC)
- Adaptive Cruise Control (ACC)
- Trailer EBS
- Trailer EBS w / roll stability

EBS

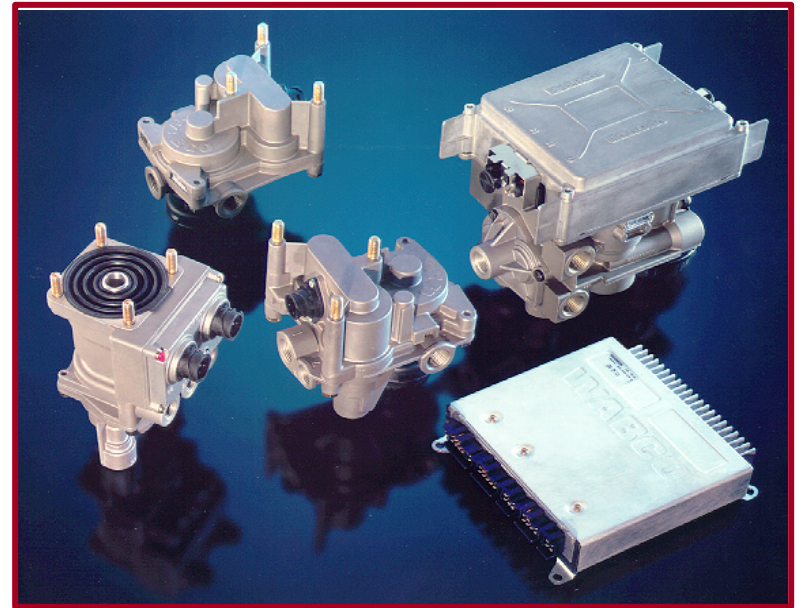
Improved Braking Performance & Safety



Electronic Braking System (EBS)

“Brake By Wire”

- EBS is a natural evolution of ABS
 - Pneumatic logic replaced by electronics
- EBS launch occurring in phases
 - Full pneumatic back-up (1998)
 - Partial pneumatic back-up (2003)
 - Next generation (2003)

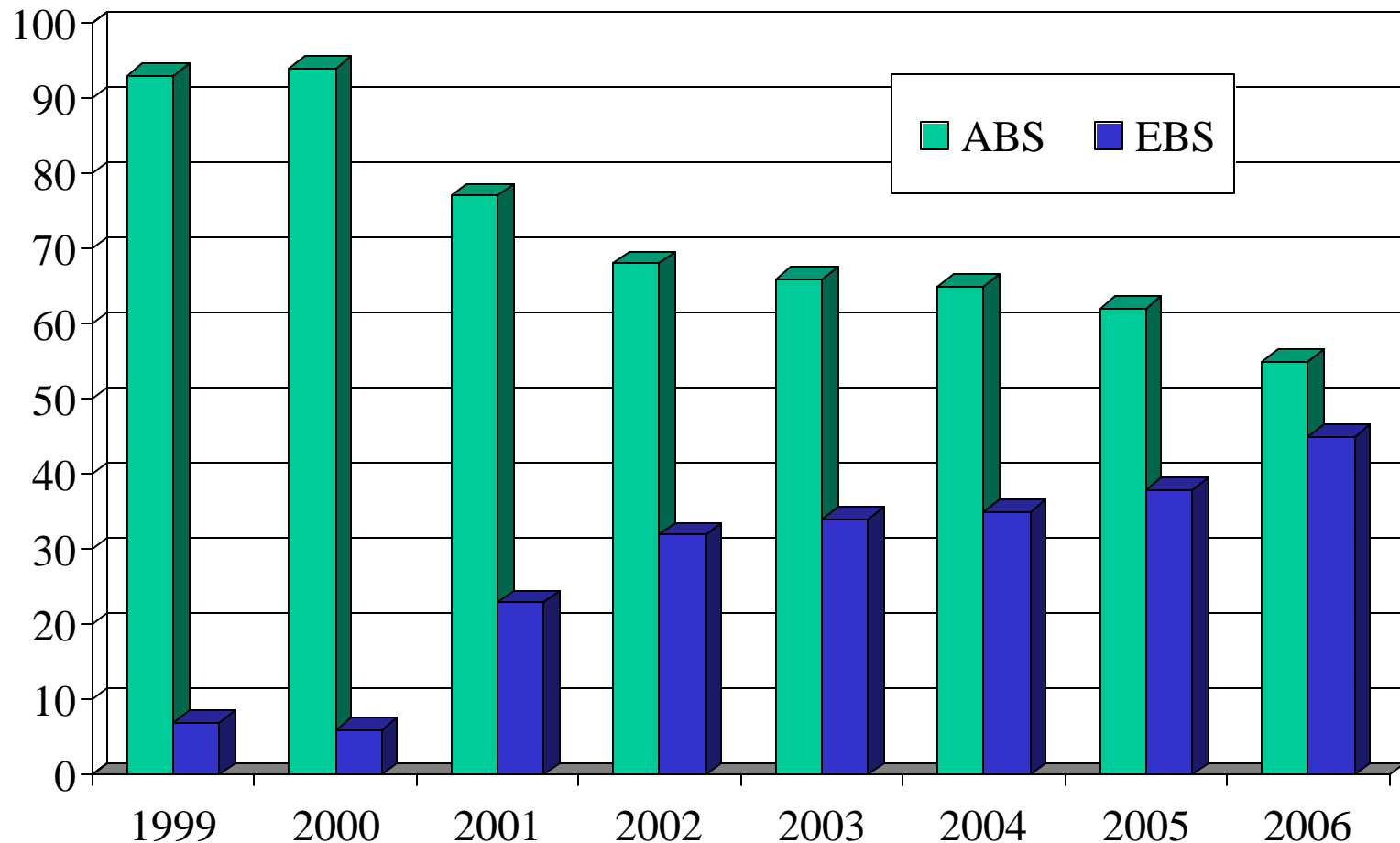


EBS Overview

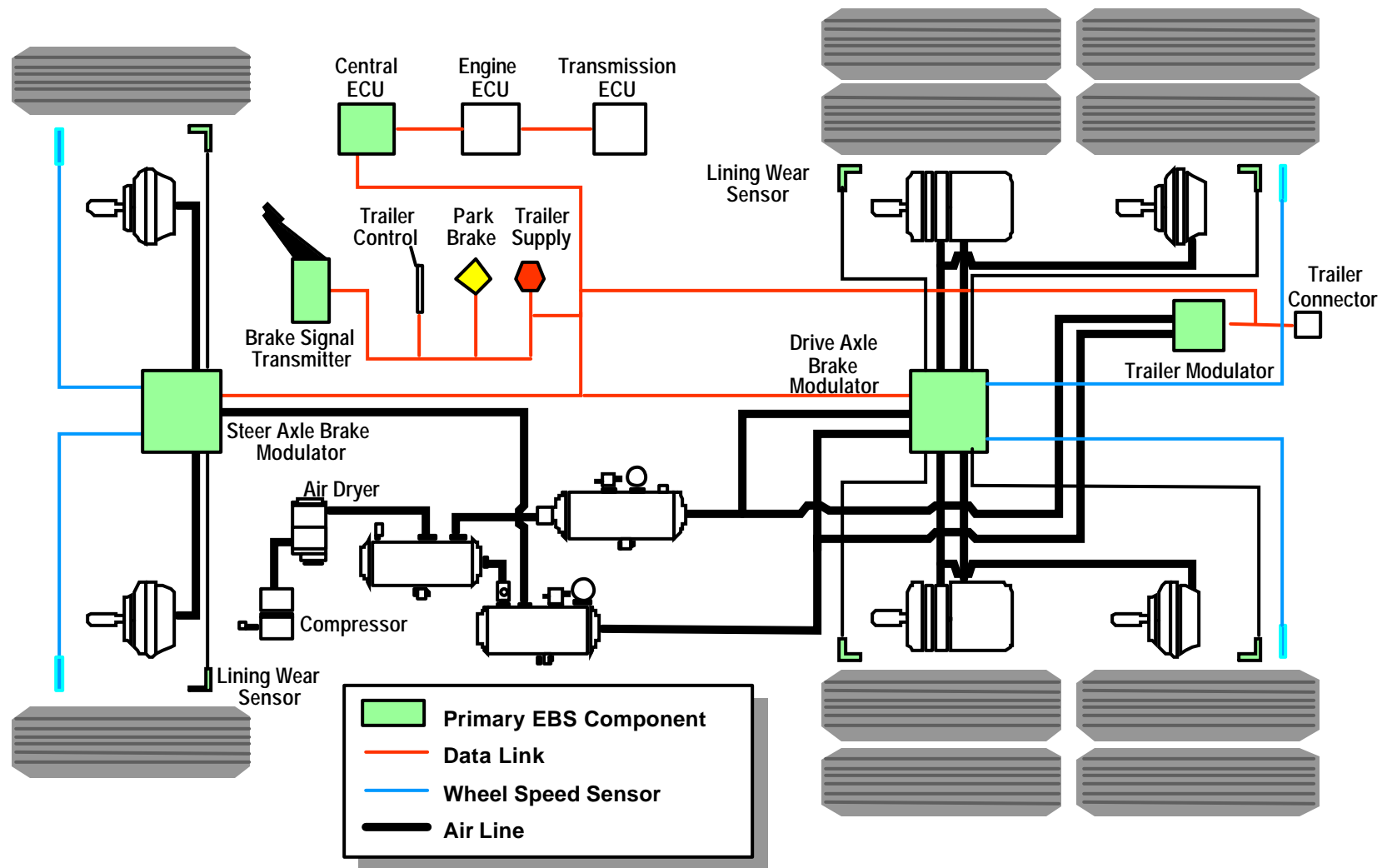
- Development started in early 1980's
- Achieved full development team strength in early 1990's
- Active field testing began mid-1990's
- Production began in July, 1996
- EBS systems are now standard production in Europe

ABS / EBS Share of Market (Europe)

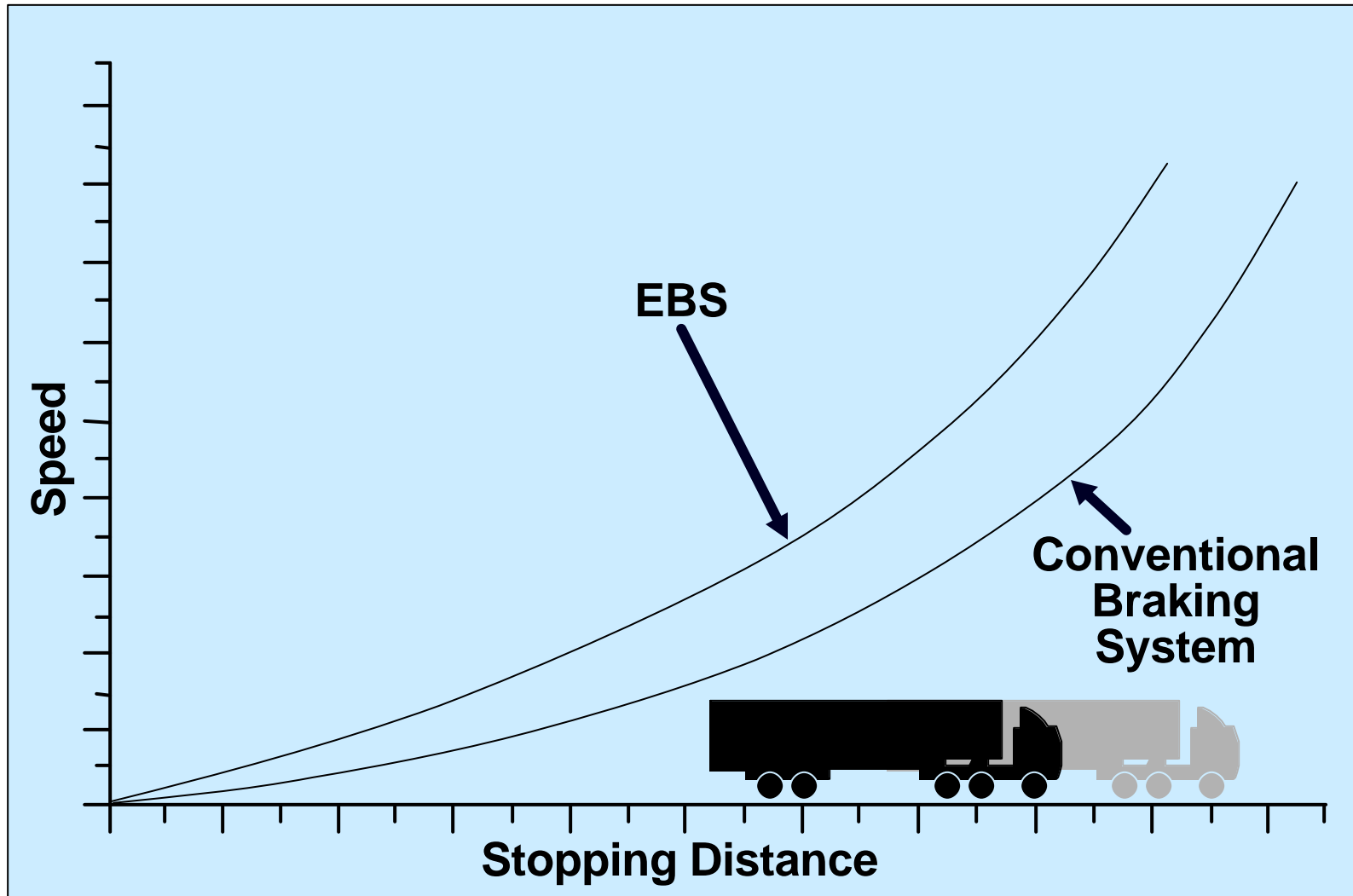
Percent



EBS for 6 x 4 Tractor



Reduced Stopping Distance



Benefits of EBS

- Continuous adjustment of brake pressures via software
- Compensation for brake force variation
 - Equalization of lining wear
- Responsive and accurate control of each brake
- Monitoring of brake adjustment
- Integrated control of retarders



Enhanced Diagnostics



Benefits of EBS

- Continuous monitoring of brake system
 - Brake performance
 - Wear
 - Air system leakage
- Datalink communication with other vehicle electronic systems
- Preventive maintenance information

EBS Next Steps

- Current hybrid EBS is another step toward improved braking technology
- Changes to FMVSS 121 could simplify EBS system configurations
- Maturity and acceptance of first generation systems is leading towards “full EBS” in the future
- Integration of Electronic Stability Control (ESC), Adaptive Cruise Control (ACC)

Electronic Braking System

EBS

with

Electronic Stability Control

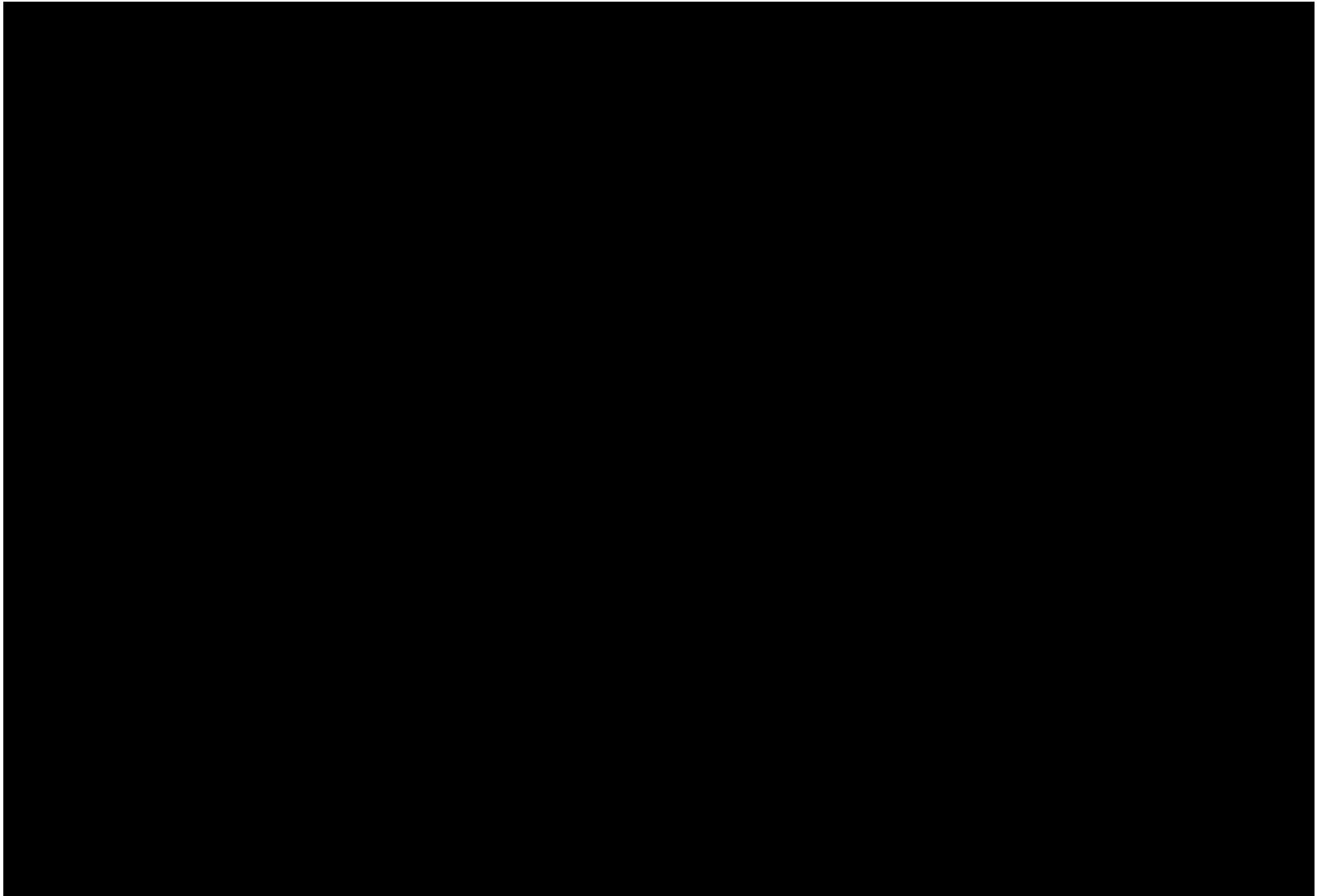
ESC

EBS With Electronic Stability Control

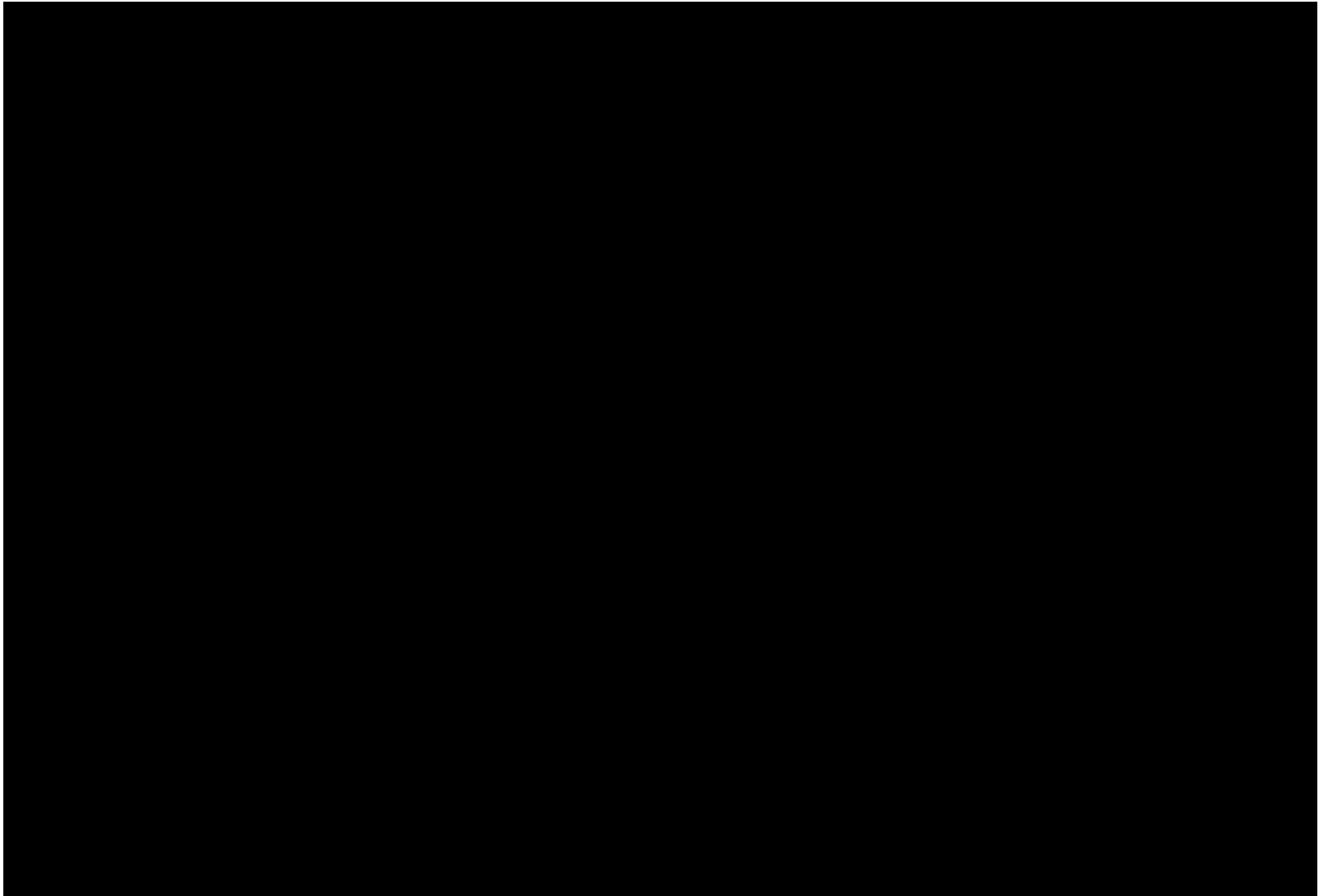
OBJECTIVES

- Detect potential spin-out situations
- Assist driver in keeping intended course during cornering maneuvers
- Stabilize vehicle when lateral traction limits are exceeded
 - Controls tractor and / or trailer brakes
 - Speed reduction by engine and brake control

Without Roll Stability Control



With Roll Stability Control

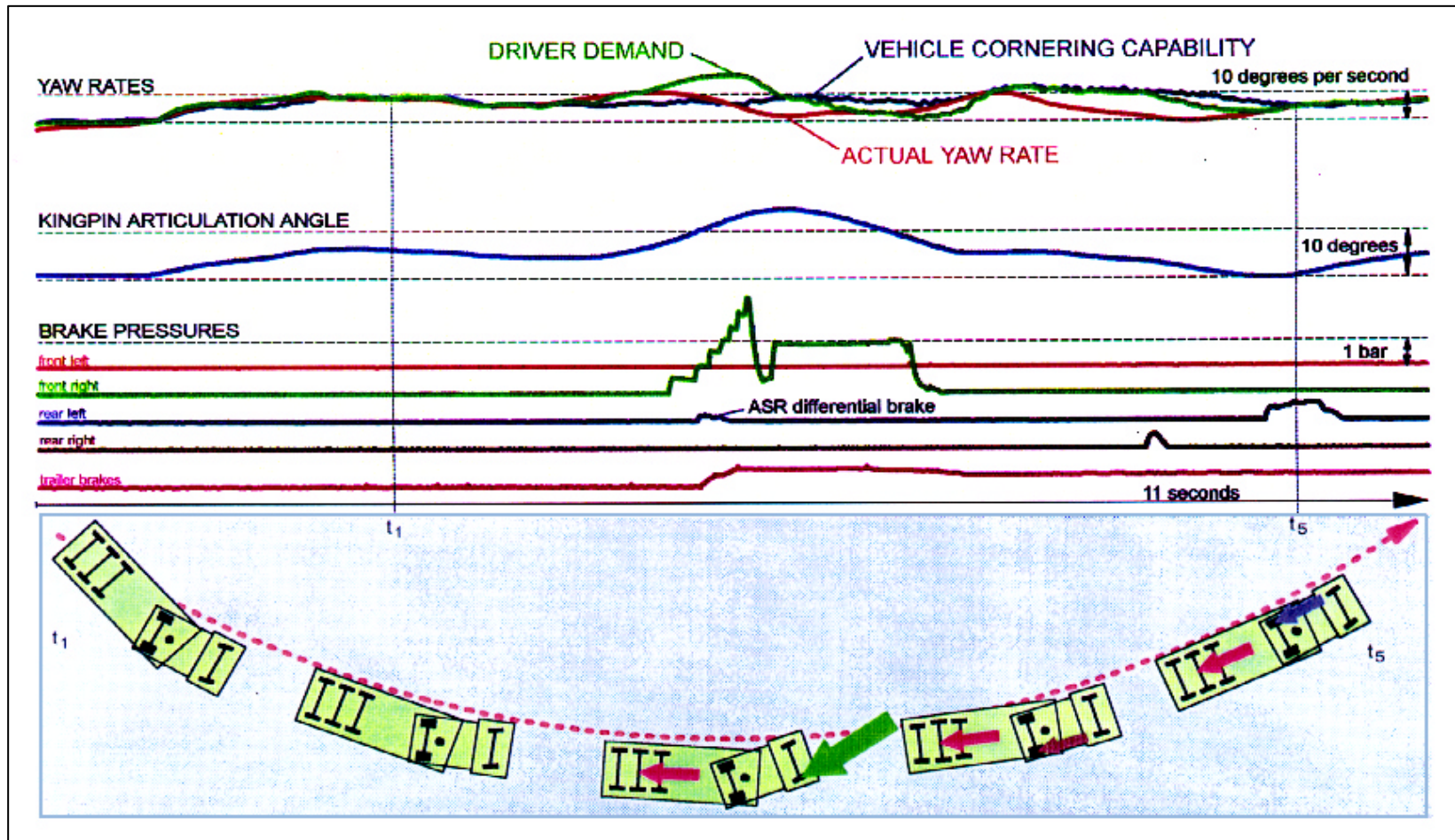


EBS With Electronic Stability Control

- Integration of functions
 - Engine control
 - ABS and traction control
 - Individual brake pressure control
 - Retarder control
 - Trailer brake control
- Utilizes additional input data
 - Steer angle
 - Yaw rate
 - Lateral acceleration

EBS With ESC

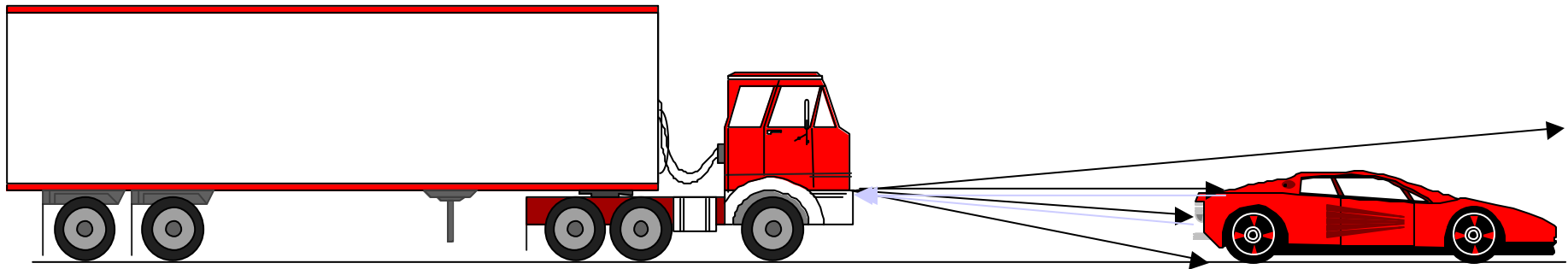
Cornering on Low μ at 55 KM / H



Adaptive Cruise Control (ACC)

Adaptive Cruise Control (ACC)

- ACC is a new radar controlled system for driver assistance
- Maintains a safe distance from vehicle ahead
- With no vehicle ahead, ACC acts like conventional cruise control
- ACC integrated with EBS and ESC brings us one step closer to collision avoidance



Trailer EBS

Trailer EBS with Roll Stability

- Roll stability control can be implemented in the trailer EBS
 - No additional hardware
 - Software solution
- Lateral acceleration calculated from side to side wheel speed differences
 - 4 wheel speed sensors required
 - Load sensor signal from suspension air bags

Trailer EBS with Roll Stability (cont'd.)

- When a critical acceleration is detected (during curved road , dry lane change) trailer brakes are automatically applied
 - Vehicle speed reduced lowering lateral acceleration
- System can help prevent rollover, cannot totally eliminate occurrences
 - System is a driver aid, driver still remains the critical component

